(4) Progressively cooling and fluctuating climates typify the late Pliocene (with *Globorotalia tosaensis*) which ended with the cold climax of the first intense Pleistocene glaciation and extreme low sea level stand.

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ALGAL MUDSTONE MOUNDS IN MORROWAN STAGE (LOWER PENNSYLVANIAN) IN NORTHEASTERN OKLAHOMA

The middle of the Morrowan Stage is marked by the development of an algal carbonate mudstone. The area of exposure covers 700 sq mi in northeastern Oklahoma with a maximum development of 60 ft in the southwestern 30 sq mi of the outcrop. A broad algal bank and smaller algal mounds developed within the area of maximum thickness, on the southwestern margin of the Ozark uplift. This area has high faunal diversity and the bank is cut irregularly by channels of skeletal sandstone. Northeastward, the faunal diversity of the unit is low, and the mudstone thins owing to replacement by skeletal grainstones and shale.

The algal mounds are up to 6 ft high and 10 ft across. The core material consists of *Archaeolithophyllum* and *Cuneiphycus* mudstone and boundstone, whereas the flank and intermound material consists of coarse skeletal packstone and wackestone. Influx of fine terrigenous clastics occurred during formation of this unit, as shale is present in small thin streaks and pockets. Locally, oolitic packstones and beds of algal oncoliths are found in the top. The mudstone is encompassed between skeletal grainstone throughout the areas of exposure.

The overall dearth of skeletal debris, abundance of algae, occurrence of stromatolite-type boundstone, burrowing, and occurrence of dolomite indicate that the mudstone was formed in a shallow subtidal or tidal-flat environment. Abundant recrystallization of matrix mud to microspar and pseudospar has taken place, and dolomite, ferroan dolomite, and siderite are present locally as replacement of skeletal debris and mud matrix.

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POSITIVE ELEMENTS WITHIN OUACHITA TECTONIC BELT IN TEXAS

Two major positive elements south and east of the foreland basins marginal to the Ouachita tectonic belt in Texas have been confirmed by wells drilled by Shell Oil Company and by seismic data in and adjacent to the concealed structural belt.

Foreland facies sediments (dominantly carbonates) of early and possibly middle Paleozoic age were drilled on the Devils River uplift in southwest Texas. In addition, much of the Devils River uplift is apparently underlain by a Precambrian intrabasement basaltic flow(?) which has been mapped from seismic reflections and penetrated in Shell No. 1 Stewart.

The presence of a second major linear positive element covered by lower Paleozoic foreland rocks has been established in east-central Texas by seismic records and by Shell No. 1 Barrett. This faulted anticlinorial structure, herein named the Navarro uplift, is at least 25 mi behind the leading edge of overthrust Ouachita facies rocks. It appears to be similar in structural position and history to the Devils River uplift but the data are insufficient to determine definitely the structural style of either.

Foreland strata are metamorphosed to greenschist facies. Some formation fluids and minor hydrocarbon shows were recovered but the quality of the reservoir was generally poor. The carbonates on the Navarro uplift contain extensive shear and flowage structures and resemble the marbles in wells on the south flank of the Devils River uplift.

Isotopic age dates from both Ouachita facies and foreland rocks record multiple Paleozoic thermal events and probable accompanying deformation along the tectonic belt. The isotopic data also suggest the presence of a post-Precambrian, pre-Late Cambrian volcanic and metasedimentary province in the area of the Devils River uplift.

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CAN AN OCEAN DRY UP? RESULTS OF DEEP-SEA DRILLING IN MEDITERRANEAN

Between 5 and 6 m. y. ago, at the climax of an episode of evaporite deposition, a series of events occurred on the floor of the Mediterranean Sea which left a fossil imprint reminiscent of a parched salina. The primary evidence of this unexpected happening was unearthed in the uppermost layers of a bedded sequence of evaporite salts of late Miocene age which were retrieved from beneath the present sea floor during Leg 13 of the Deep Sea Drilling Project. In continuous sections of core the shipboard scientific team discovered a remarkable transition from sterile chemical precipitates (gypsum, anhydrite, and halite) to deep-sea pelagic sediment. At all the sites drilled, the transition occurred between Miocene salts and Pliocene biogenic ooze.

In the eastern Mediterranean, the transition consisted of a 10-cm thick zone of dolomite gravel containing littoral benthonic fauna. Beneath the Balearic abyssal plain in the western Mediterranean, the corresponding zone is a 2-m thick bed of flat-pebble conglomerate directly overlying a massive unit of current-bedded gypsiferous sandstone. In the central Tyrrhenian basin the transition involved a pebbly breccia composed of lateritic soils, strikingly similar in lithology to the *limons rouges* of littoral sequences in North Africa and Italy.

The most plausible explanation of these findings is that a once actively precipitating deep brine basin became choked off from the open ocean and evaporation continued to the point of desiccation. Thereafter, the newly formed desert disappeared under a major marine inundation.

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GEOLOGIC APPLICATIONS OF REMOTE SENSING

For optimum geologic application of remote sensing, the user should understand the advantages, limitations, and characteristics of the various types of imagery. Selection of the optimum sensor or combination of sensors will depend upon these factors plus the nature of the terrain, geology, and the problem at hand.

Newer types of films and image processing have greatly expanded the geologic potential of conventional black and white aerial photography. Infrared color film and multiband photography extend the sensitivity range and provide greater spectral discrimination. These techniques can enhance subtle variations in soil, vegetation,